Docket No.: KC-17,872

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicants:	Sridhar RANGANATHAN Fred R. RADWANSKI Jenny L. DAY Jeffrey J. KRUEGER Gregory M. LEFKOWITZ Stanley R. KELLENBERGER Hoa La WILHELM	Group No.: 3761 Examiner: Keshia L. Gibson
Serial No.:	10/820,636	
Filing Date:	08 April 2004	
Title:	DIFFERENTIALLY EXPANDING ABSORBENT STRUCTURE	
Customer No.:	35844	

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Dear Sir:

Applicants herewith file their Appeal Brief in the above-identified case, pursuant to the Notice Of Appeal filed 30 June 2006.

I. REAL PARTY IN INTEREST

The real party in interest is Kimberly-Clark Worldwide, Inc., the assignee of the present application (as recorded at reel 015627, frame 0899).

I hereby certify that this correspondence (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on

7-28-06

7-28-06
Date

Signature

2. RELATED APPEALS AND INTERFERENCES

Applicants are not aware of any related appeals or interferences.

3. STATUS OF CLAIMS

Claims 1, 3, 7-15, 17-22 and 24-43 are pending. All claims have been rejected at least twice, and all claims have been rejected or objected to three times. All claims were finally rejected in a final Office Action dated 05 April 2006, and no claim has been amended since then. Therefore, all claims meet the requirements for appeal under 37 C.F.R. § 41.31(a).

In a subsequent Office Action dated 15 June 2006, the claims were made subject to an improper after-final restriction requirement, contrary to M.P.E.P. § 811 and 37 C.F.R. § 1.142(a). Applicants have invested considerable time, effort and expense in responding to three detailed Office Actions addressing all of the claims on the merits. Instead of responding to the restriction requirement, and risking a substantial restriction of patent coverage, Applicants hereby appeal the failure to allow all of the pending claims, pursuant to the rights provided in 37 C.F.R. § 41.31(a).

4. STATUS OF AMENDMENTS

All amendments thus far have been entered. No amendment was submitted subsequent to the final Office Action dated 05 April 2006, in which all of the claims were rejected.

5. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention is generally directed to an absorbent structure that expands when wetted to assume a concave shape. The concave shape results from the fact that a first surface or layer expands to a greater extent than a second surface or layer in the presence of a liquid.

As recited in independent Claim 1, one embodiment of the invention is directed to a single-layer absorbent structure comprising:

> a first surface opposite a second surface, wherein the single-layer absorbent structure expands along the second surface in the presence of a liquid so that the first surface increases concavity in the presence of the liquid, the single-layer absorbent structure expands to a lesser extent along the first surface than the single-layer absorbent structure expands along the second surface in the presence of the liquid, the single-layer absorbent structure has a fluid intake rate of about 0.5 cubic centimeters per second or

greater measured using the Fluid Intake Rate Test, and the single-layer absorbent structure has a thickness of about 1 to about 10 millimeters in a dry state.

As recited in independent Claim 17, another embodiment of the invention is directed to a multilayer absorbent structure comprising:

a first layer that expands less than 10% in the presence of a liquid; and

an absorbent second layer having a basis weight between about 100 and about 1000 grams per square meter bonded to the first layer, wherein the absorbent second layer expands at least 20% in the presence of the liquid so that the second layer increases concavity along an interface of the first and second layers in the presence of the liquid, and the absorbent structure has a fluid intake rate of about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test.

As recited in independent Claim 30, another embodiment of the invention is directed to an absorbent article including the inventive absorbent structure, but not limited to a single-layer or multilayer absorbent structure. The absorbent article comprises:

a body side liner;
an outer cover; and
an absorbent structure having a basis weight between about 50 and about 1000 grams per square meter positioned between the body side liner and the outer cover, wherein the absorbent structure includes a first surface opposite a second surface, the second surface of the absorbent structure is bonded to the outer cover, the absorbent structure expands along the second surface in the presence of a liquid so that the first surface increases concavity in the presence of the liquid, the absorbent structure expands to a lesser extent along the first surface than the absorbent structure expands along the second surface in the presence of the liquid, and the absorbent structure has a fluid intake rate of at least about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test.

Independent Claim 41 is directed to another embodiment of the single-layer absorbent structure, comprising:

a first surface opposite a second surface, wherein the single-layer absorbent structure expands along the second surface in the presence of a liquid so that the first surface increases concavity in the presence of the liquid, the single-layer absorbent structure expands to a lesser extent along the first surface than the single-layer absorbent structure expands along the second surface in the presence of the liquid, the single-layer absorbent structure has a fluid intake rate of about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test, and at least one of the first and second surfaces undergoes anisotropic expansion in the presence of the liquid.

Independent Claim 42 is directed to another embodiment of the multilayer absorbent structure, comprising:

> a first layer having a basis weight between about 10 and about 150 grams per square meter that expands less than 10% in the presence of a liquid; and
>
> an absorbent second layer bonded to the first layer, wherein the absorbent second layer expands at least 20% in the presence of the liquid so that the second layer increases concavity along an interface of the first and second layers in the presence of the liquid, and the absorbent structure has a fluid intake rate of about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test.

Independent Claim 43 is directed to another embodiment of the multilayer absorbent structure, comprising:

> a first layer that expands less than 10% in the presence of a liquid; and
>
> an absorbent second layer bonded to the first layer, wherein the absorbent second layer expands at least 20% in the presence of the liquid so that the second layer increases concavity along an interface of the first and second layers in the presence of the liquid, the absorbent structure has a fluid intake rate of about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test, and only one of the first and second layers is elastomeric.

As explained on page 10, lines 25-32 of the specification, the differential swelling characteristics between the first and second surfaces, and/or the first and second layers, cause the absorbent structure to deform out of plane and increase concavity when proceeding from a dry state to a wet state. The increase in concavity causes a cup-like, bucket-like, trough-like or similar indented shape which is particularly suitable for collecting bodily fluids or other bodily wastes to facilitate improved absorbency, skin health, and/or fit of absorbent articles.

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The following grounds of rejection were presented in the final Office Action dated 05 April 2006, and are submitted for review on appeal:

A. The rejection of Claims 1, 3, 7-15, 17-22, and 24-43 under 35 U.S.C. § 112, first paragraph, based on lack of enablement;

B. The rejection of Claims 1, 3, 7-8, 10-15, 21 and 41 under 35 U.S.C. § 102(b) as anticipated by, or under 35 U.S.C. § 103(a) as obvious over U.S. Patent 5,460,621 ("Gertzman et al.");

C. The rejection of Claims 1, 3, 7, 10, 12-15 and 41 under 35 U.S.C. § 102(b) as anticipated by, or under 35 U.S.C. § 103(a) as obvious over U.S. Patent 5,591,150 ("Olsen et al.");

D. The rejection of Claim 43 under 35 U.S.C. § 102(b) as anticipated by, or under 35 U.S.C. § 103(a) as obvious over International Publication WO 01/15649 ("Abbas et al.");

E. The rejection of Claims 9, 17-20, 22, 24-25, 28-29 and 42 under 35 U.S.C. § 103(a) as obvious over Gertzman et al.; and

F. The rejection of Claims 9, 17-20, 22, 24-40 and 42 under 35 U.S.C. § 103(a) as obvious over Olsen et al.

At this point, all of the claim rejections have been maintained by the Examiner. Although Applicants filed a Request For Reconsideration on 12 May 2006, seeking withdrawal of the final rejections, the Examiner did not respond in kind. In the Office Action dated 15 June 2006, the Examiner withdrew the finality of the claim rejections but did not withdraw the actual claim rejections:

> Applicants' request for reconsideration of the finality of the rejection in the last Office Action in the response dated 5/15/06 is persuasive and, therefore, the finality of that action is withdrawn (15 June 2006 Office Action, page 2).

In fact, Applicants never asked the Examiner to withdraw the finality of the claim rejections such that the claim rejections would be maintained but made non-final. In any event, all rejections of the pending claims formally stand, and no claim rejection has been withdrawn.

7. ARGUMENT

A. The Rejection Of Claims 1, 3, 7-15, 17-22 And 24-43 Under 35 U.S.C. § 112, First Paragraph, Should be Reversed

Claims 1, 3, 7-15, 17-22 and 24-43 stand rejected under 35 U.S.C. § 112, first paragraph. The Examiner argues that the specification while being enabling for a fluid

intake rate of up to 5 cubic centimeters per second, does not reasonably provide enablement for a fluid intake rate of about 0.5 cubic centimeters or greater. According to the Examiner, a fluid intake rate of about 0.5 cubic centimeters or greater would encompass fluid intake rates up to infinity, and the specification is not enabling as such (05 April 2006 Office Action, page 5).

First, the Examiner has mischaracterized Applicants' specification as describing a fluid intake rate of "up to 5 cc/sec." Nowhere does Applicants' specification state that 5 cm^3/sec is an upper limit. Contrary to the Examiner's representation, the specification (p. 10 lines 4-10) states only that a fluid intake of about 5 cc/sec is a lower limit in one embodiment:

> The surface of the absorbent structure 20 that faces a user or is expected to be in contact with liquid during use should have the ability to allow liquid to penetrate through the surface at a relatively rapid rate. Thus, the absorbent structure 20 suitably has a fluid intake rate of about 0.5 cubic centimeters per second (cc/s) or greater, or about 1 cc/s or greater, or about 2 cc/s or greater, or about 5 cc/s or greater. The fluid intake rate can be measured using the Fluid Intake Rate Test described in detail below.

For purposes of the invention, only the lower limit of fluid intake rate is important because it defines a minimum efficiency for the claimed absorbent structure. No upper limit has been disclosed or claimed because, for purposes of the invention, an upper limit is not important. Applicants have no reason to define an upper limit because to do so would only limit the efficiency of the absorbent article. Applicants agree that if an upper limit were claimed, then there would be a duty to support it. However, Applicants have no duty to support any limitation that is not stated in the claims. The Examiner has cited no case law that holds to the contrary, and Applicants' attorney is aware of none.

Applicants' independent Claims 1, 17, 30 and 41-43 are written using the transition word "comprising." This means that the independent claims are open-ended, and cover absorbent structures which embody the claim limitations alone or combined with additional ingredients and parameters that are not recited in the claims. This is true whether or not the additional, unrecited ingredients and parameters are stated in the specification. There is no duty to enable any and all unrecited ingredients and parameters that are within the scope of an open-ended claim. The Examiner has cited no case law that holds to the contrary, and Applicants' attorney is aware of none.

Presumably, if Applicants simply deleted the "fluid intake rate" language from the independent claims (or failed to recite it in the first place), the enablement rejection would be avoided. However, claims which recite no fluid intake rate at all would necessarily cover absorbent structures having fluid intake rates ranging from very low to very high, with no upper limit. No upper limit would have been stated in the specification or claims, yet there would have been no basis for an enablement rejection.

Instead of leaving the claims open to fluid intake rates ranging from very low to very high levels, Applicants have chosen to restrict the range by stating only a lower limit. The fact that Applicants have stated no upper limit provides no more rationale for an enablement rejection than if a fluid intake rate had not been stated at all. Whether a fluid intake rate is not stated at all, or whether only a lower limit is stated, there is no defined upper limit.

Persons of ordinary skill in the art would understand this, and would have no difficulty making the invention as claimed. See MPEP 2164.08 (All that is necessary is that one skilled in the art be able to practice the claimed invention, given the level and knowledge of skill in the art. Further the scope of enablement must bear only a "reasonable correlation" to the scope of the claims). This rejection should be reversed.

B. The Rejection Of Claims 1, 3, 7-8, 10-15, 21 And 41 Based On Gertzman et al. Should Be Reversed

Claims 1, 3, 7-8, 10-15, 21 and 41 stand rejected under 35 U.S.C. § 102(b) as anticipated by, or under 35 U.S.C. § 103(a) as obvious over U.S. Patent 5,460,621 ("Gertzman et al."). The Examiner alleges that the two-layer absorbent structure disclosed in Gertzman et al. is a single layer structure as recited in the rejected claims, because two layers bonded together form a single layer (05 April 2006 Office Action, pages 2-3).

The Examiner has disregarded one of the most fundamental tenets of patent law, that claim limitations are to be interpreted according to the meaning provided in Applicants' specification. While other sources may be consulted in understanding ambiguous terms, it is impermissible to defy a plain meaning provided in the specification by substituting a second, contradictory meaning derived from another source. The person skilled in the art is deemed to read a claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire specification. Phillips v. AWH Corp., 75 USPQ 2d 1321 (Fed. Cir. 2005). The Examiner is required to

construe the claims in the same manner as they would be by persons of ordinary skill in the art. Id, 75 USPQ 2d at 1326, 1329.

It is undisputed that Gertzman et al. discloses a two-layer absorbent structure (Figs. 1-5). Applicants' Claims 1 and 41, by contrast, require a single-layer absorbent structure. In rejecting Claims 1, 3, 7-8, 10-15 and 41 based on Gertzman et al., the Examiner stated that two layers joined together constitute a single-layer absorbent structure. However, the Examiner has not pointed to a passage in Applicants' specification which supports this unique and very unusual interpretation of "single-layer absorbent structure." In fact, the specification provides no support for the Examiner's interpretation.

Contrary to the Examiner's interpretation, Applicants' specification presents a clear and inescapable distinction between single-layer and multi-layer absorbent structures:

> The absorbent structures of the invention include one or more layers that, in the absence of a liquid, may be thin and flexible enough to lie flat...in a single-layer embodiment, one surface of the structure possesses different swelling behavior in the presence of a liquid compared to the opposite surface of the structure. In a multi-layer embodiment, at least a first layer and a second layer are laminated together such that they remain attached to one another when wet...(p. 2 lines 6-20).

Thus, a two-layer absorbent structure in which both layers are joined together is unambiguously described as a multi-layer structure in Applicants' specification. A single-layer absorbent structure, as recited in Claim 1, means exactly what it says, i.e. a structure having only one layer. The terms "single-layer" and "multi-layer" are mutually exclusive, and do not overlap. The Examiner is required to honor the plain meaning provided in Applicants' specification, when searching the prior art for a single-layer absorbent structure.

Gertzman et al. plainly does not disclose a single-layer absorbent structure as required by Claims 1-3, 7-8, 10-15 and 41. Furthermore, the reference does not disclose a single-layer absorbent structure which expands to a lesser extent along a first surface than along a second surface in the presence of a liquid. Furthermore, the reference does not disclose a single-layer absorbent structure having a fluid intake rate of about 0.5 cm^3/sec or greater measured using the Fluid Intake Rate Test.

As to the obviousness rejection under 35 U.S.C. § 103(a), Gertzman et al. discloses that two layers (as opposed to a single layer) are essential to the operation of the disclosed invention:

> The inventive sponge composition uses a compound sponge material made of two or more layers of PVAc sponge, one of which is preferably CF50 as the base low density sponge layer and another greater density or smaller pore size sponge CF number between 150 and 400 as the other layer. The compound sponge has the property of curling or unfolding depending on its shape because of the differences in the material properties of the layers (Col. 4, lines 47-54).

As shown above, the invention of Gertzman et al. requires two or more layers having different densities and pore sizes to effect the curling or unfolding of the sponge when it becomes wet. It is not obvious to modify a prior art reference in a manner which defeats its intended purpose, and/or which changes its principle of operation. See MPEP 2143.01. Accordingly, this claim rejection should be reversed.

Claim 21 depends from Claim 17. Therefore, the rejection of Claim 21 based on Gertzman et al. is discussed along with the separate rejection of Claim 17, below.

C. The Rejection Of Claims 1, 3, 7-10, 12-15 And 41 Based On Olsen et al. Should be Reversed

Claims 1, 3, 7-10, 12-15 and 41 stand rejected under 35 U.S.C. § 102(b) as anticipated by, or under 35 U.S.C. § 103(a) as obvious over U.S. Patent 5,591,150 ("Olsen et al."). The Examiner alleges that Olsen et al. disclose an insert which, when placed in an absorbent article and combined with an absorbent core, forms a single-layer structure having a concave shape (05 April 2006 Office Action, pages 9-10).

Independent Claims 1 and 41 require a single-layer absorbent structure interpreted according to Applicants' specification (meaning an absorbent structure having only one layer). As stated by the Examiner, one absorbent structure disclosed in Olsen et al. (defined by a combination of absorbent core 22 and resilient insert 44) has more than one layer. Olsen et al. discloses an alternative embodiment in which the resilient insert 44 serves as the absorbent core (Col. 12, lines 9-26 and Col. 18, lines 7-11). Yet the disclosed insert does not anticipate or render obvious any of Applicants' claims because the disclosed insert does not curve in the presence of a liquid, due to expansion of one surface relative to another.

The resilient insert disclosed in Olsen et al. may either be pre-formed as a curved insert, or it may assume a curved shape during use (Col. 3, lines 6-23). When the insert curves during use, the curvature results from the pressure and motion imparted by a wearer's body (Col. 9, lines 55-67). The Examiner attempts to equate this curvature with the curvature of Applicants' absorbent structure, which results from expansion of one surface relative to another in the presence of a liquid. In so doing, the Examiner overlooks important claim limitations. Clearly, any resilient member will flex and bend under pressure. Olsen et al. has nothing to do with Applicants' claimed invention.

The Examiner argues that the phrase "expands...in the presence of a liquid" does not create a cause-and-effect relationship (05 April 2006 Office Action, page 3). Again, the Examiner is interpreting claim language in a manner which contradicts Applicants' specification. A reasonable person of ordinary skill in the art, having read the specification, would understand perfectly well what is meant by the claim language. A first surface or layer expands in the presence of a liquid to a lesser extent than a second surface or layer, resulting in increased concavity that would not otherwise exist.

Accordingly, this claim rejection should be reversed.

D. The Rejection Of Claim 43 Based On Abbas et al. Should Be Reversed

Claim 43 stands rejected under 35 U.S.C. § 102(b) as anticipated by, or under 35 U.S.C. § 103(a) as obvious over International Publication WO 01/15649 ("Abbas et al."). Again, the Examiner overlooks important claim limitations.

Abbas et al. discloses an absorbent porous structure including a liquid acquisition portion and a liquid storage portion. The liquid acquisition portion includes a compressed polymeric open-cell foam which expands upon wetting. The liquid storage portion includes a polymeric open-cell foam which can be the same or different than the foam in the liquid acquisition portion (Abstract).

Claim 43 recites an absorbent structure comprising first and second layers, wherein only one of the first and second layers is elastomeric. The Examiner has not addressed this limitation, and has not cited any passage in Abbas et al. that is pertinent to this limitation. According to Abbas et al., both the liquid acquisition layer 3 and the liquid storage layer 4 of the absorbent structure comprise a compressed foam material (p. 5 lines

25-36). The two layers have similar properties, and it is not reasonable to assume that one is elastomeric while the other is not.

Abbas et al. discloses that both foam layers are compressed in the z-direction, when dry, with the liquid acquisition layer 3 being compressed to a greater extent than the liquid storage layer 4 (p. 5 lines 34-36). When the foam layers absorb liquid, they decompress and expand in the z-direction, as shown in Figs. 1 and 2 (p. 6 lines 12-17). No lateral compression or subsequent lateral expansion of either layer is disclosed. By comparing Figs. 1 and 2 of Abbas et al., it is seen that both foam layers have precisely the same lateral dimension after absorption of a liquid as they do in the dry state. Accordingly, the interface between the first and second foam layers remains a straight line. Abbas et al. does not disclose an increase in concavity along an interface between the first and second layers, as required by Claim 43.

For these reasons, this claim rejection should be reversed.

E. The Rejection Of Claims 9, 17-22, 24-25, 28-29 And 42 Based On Gertzman et al. Should Be Reversed

Claims 9, 17-20 22, 24-25, 28-29 and 42 stand rejected under 35 U.S.C. § 103(a) as obvious over Gertzman et al. As mentioned above, Claim 21 (which depends from Claim 17) also stands rejected based on Gertzman et al.

Claim 9 depends from Claim 1 and is patentable over Gertzman et al. for at least the same reasons, explained above.

Independent Claims 17 and 42 recite an absorbent structure comprising a first layer that expands less than 10% in the presence of a liquid and a second layer that expands at least 20% in the presence of the liquid, the second layer bonded to the first layer and having a basis weight of about 100 to about 1000 grams/m^2. Gertzman et al. plainly does not disclose this type of structure. In the absorbent structure of Gertzman et al., all layers are formed of the same polymer, which is polyvinyl acetal (Col. 4, lines 47-52).

Polyvinyl acetal is a highly water-absorptive material having the capacity to absorb up to 16 times its weight in fluids measured using a fluid retention test, ASTM D1117-80 (Col. 4, lines 16-24). Due to air space, the sponges made from polyvinyl acetate provide for a higher absorption of up to 25 times their weight. The sponges are intended to conform (through expansion) to the precise shape of an internal cavity or site required for organ protection during surgery, or to displace and move organs and tissue without

damaging them (Col. 4, lines 25-28). Because the different layers have different pore sizes and densities, one may expand more than the other to cause curling. Yet both layers expand substantially more than 10%, and neither layer expands more than double the amount of the other, as would be required to read on Applicants' Claims 17 and 42.

Water has a density of 1.0 grams/cm^3, and is not compressible. Assuming the polyvinyl acetal has a density of about 1.0 grams/cm^3, the absorption of 16 times its weight in water would cause a volumetric expansion of 1600%. Minor variations in density of one polyvinyl acetal versus the other would affect the percentage expansion to a degree. However, no polyvinyl acetal polymer can absorb 16 times its weight in water while expanding less than 10%. Furthermore, while the basis weight of a layer might affect its overall expansion (as indicated by the Examiner), it should not influence the percent expansion.

Put another way, the disclosed absorbent polyvinyl acetal sponge may absorb up to 25 times its weight in water. Much of the absorption (16 times the sponge weight) results from absorptive properties of the polymer and causes a proportional expansion. The remainder of the sponge absorption is due to filling of air space within the sponge. The sponge must expand by an amount which reflects the absorption by the polymer.

Fig. 1 of Gertzman et al. illustrates the sponge material in the dry state. Fig. 2 illustrates the same material in the wet, expanded state. Comparison of Figs. 1 and 2 suggests that both layers expand substantially more than 10%, in at least the z-direction, with additional expansion occurring in the x and y directions. Apparently, neither layer expands more than double the amount of the other. Based on these differences, Claims 17 and 42 are patentable. Claims 18-20, 22, 24-25 and 28-29 depend from Claim 17, and are patentable for at least the same reasons.

Accordingly, this claim rejection should be reversed.

F. The Rejection Of Claims 9, 17-20, 22, 24-40 And 42 Based On Olsen et al. Should Be Reversed

Claims 9, 17-20, 22, 24-40 and 42 stand rejected under 35 U.S.C. § 103(a) as obvious over Olsen et al. Claim 9 depends from Claim 1 and is patentable over Olsen et al. for at least the same reasons, explained above.

Independent Claims 17 and 42 recite an absorbent structure including a first layer that expands less than 10% in the presence of a liquid and a second layer that expands at least 20% in the presence of the liquid, so that the second layer increases concavity along an interface between the first and second layers. Olsen et al. does not disclose these limitations. As explained above, the described concavity of the resilient member in Olsen et al. either a) occurs during manufacture of the resilient member, or b) results from flexing and bending the resilient member during use of the absorbent article. This has nothing to do with concavity <u>along an interface</u> that would result from expanding the second layer relative to the first layer in the presence of a liquid.

In the embodiments relied upon by the Examiner (Fig. 4 of Olsen et al.), the insert 44 is separated from absorbent core 42 at all locations depicting a concave surface, and there is no interface at these locations. Furthermore, it does not appear that one layer has expanded less than 10% while another layer has expanded at least 20% (more than double the amount of the first layer). Accordingly, Claim 17 is patentable over Olsen et al. Claims 18-20, 22 and 24-29 depend from Claim 17 and are patentable for at least the same reasons.

While failing to identify these claim limitations in the prior art, the Examiner has categorically declared that all such limitations are merely result-effective variables (05 April 2006 Office Action, page 14). However, Olsen et al. does not rely on expansion at all to cause curvature in an absorbent structure. As explained above, Olsen et al. achieves curvature by a) providing an insert that is already curved, or b) providing a flat insert that curves due to pressure and motion imparted by a wearer's body. Neither technique has anything to do with Applicants' absorbent structure which achieves curvature in the presence of a liquid by providing for predetermined, different expansions in different layers or structures of the absorbent structure.

Independent Claim 30 is directed to an absorbent article including a bodyside liner, an outer cover and an absorbent structure between them. The absorbent

structure includes a first surface, and a second opposing surface bonded to the outer cover. The absorbent structure expands along the second surface in the presence of a liquid so that the first surface increases concavity.

As explained above, Olsen et al. does not disclose an absorbent structure whose surfaces expand differently in the presence of a liquid. Furthermore, in the structure relied on by the Examiner (Fig. 4 of Olsen et al.), the first surface (element 42) is longer than the second surface (element 44) and the first surface is convex, not concave. The second surface faces the outer cover as required by Claim 30, and the structure cannot be inverted to reverse the geometry. Claim 30 is therefore patentable over Olsen et al. Claims 31-37 and 39-40 depend from Claim 30, and are patentable for at least the same reasons.

In summary, no claim is obvious over Olsen et al. This claim rejection should be reversed.

8. CONCLUSION

For the above reasons, Applicants respectfully submit that the rejections posed by the Examiner are improper as a matter of law and fact. Applicants respectfully request the Board reverse the rejections of Claims 1, 3, 7-15, 17-22 and 24-43.

A check for the fee required by 37 C.F.R. 41.37(a)(2) and 37 C.F.R. 41.20(b)(2), in the amount of $500.00, is enclosed. Please charge any additional amount owed, or credit any overpayment, to Deposit Account 19-3550.

Respectfully submitted,

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Attachments

APPENDIX A – CLAIMS ON APPEAL

1. A single layer absorbent structure, comprising:

a first surface opposite a second surface, wherein the single-layer absorbent structure expands along the second surface in the presence of a liquid so that the first surface increases concavity in the presence of the liquid, the single-layer absorbent structure expands to a lesser extent along the first surface than the single-layer absorbent structure expands along the second surface in the presence of the liquid, the single-layer absorbent structure has a fluid intake rate of about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test, and the single-layer absorbent structure has a thickness of about 1 to about 10 millimeters in a dry state.

3. The absorbent structure of Claim 1, wherein the single-layer absorbent structure comprises at least one of the group consisting of thermoplastic foams, thermoset foams, cellulosic foams, superabsorbent foams, foam materials with superabsorbent particles embedded therein, non-foam materials with superabsorbent particles embedded therein, fibrous materials with superabsorbent particles embedded therein, coforms, staple fiber webs, netting, scrims, superabsorbent scrims, superabsorbent films, spunbond with superabsorbents, meltblown with superabsorbents, elastomeric materials, and combinations thereof.

7. The absorbent structure of Claim 1, wherein the absorbent structure has a subtended angle of about 30 degrees to about 180 degrees in the presence of a liquid.

8. The absorbent structure of Claim 1, wherein the absorbent structure has a radius of curvature of about 38 centimeters or less in the presence of a liquid.

9. The absorbent structure of Claim 1, wherein the absorbent structure has a basis weight between about 50 and about 1000 grams per square meter.

10. The absorbent structure of Claim 1, wherein the first surface is treated to expand less in the presence of a liquid relative to the extent to which the second surface expands in the presence of a liquid.

11. The absorbent structure of Claim 1, wherein the first surface is treated by at least one of the group consisting of necking, creping, pleating, aperturing, and mechanical teasing.

12. The absorbent structure of Claim 1, wherein at least one of the first and second surfaces comprises at least one slit to control shaping.

13. The absorbent structure of Claim 1, wherein at least one of the first and second surfaces comprises at least one region of reduced expansion.

14. The absorbent structure of Claim 13, wherein the at least one region of reduced expansion has been modified by at least one of the group consisting of densification, embossment, heat treatment, adhesive bonding, ultrasonic bonding, and combinations thereof.

15. The absorbent structure of Claim 1, wherein at least one of the first and second surfaces undergoes anisotropic expansion in the presence of a liquid.

17. An absorbent structure, comprising:

a first layer that expands less than 10% in the presence of a liquid; and

an absorbent second layer having a basis weight between about 100 and about 1000 grams per square meter bonded to the first layer, wherein the absorbent second layer expands at least 20% in the presence of the liquid so that the second layer increases concavity along an interface of the first and second layers in the presence of the liquid, and the absorbent structure has a fluid intake rate of about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test.

18. The absorbent structure of Claim 17, wherein the absorbent structure has a subtended angle of about 30 degrees to about 180 degrees in the presence of a liquid.

19. The absorbent structure of Claim 17, wherein the absorbent structure has a radius of curvature of about 38 centimeters or less in the presence of a liquid.

20. The absorbent structure of Claim 17, wherein the structure has a thickness of about 1 to about 10 millimeters in a dry state.

21. The absorbent structure of Claim 17, wherein at least one of the first and second layers is elastomeric.

22. The absorbent structure of Claim 17, wherein the first layer has a basis weight between about 10 and about 150 grams per square meter.

24. The absorbent structure of Claim 17, wherein the first layer comprises at least one of the group consisting of nonwoven materials, wetlaid, airlaid, spunbond, meltblown, coform, bonded-carded webs, foams, tissue, netting, scrim, woven materials, and combinations thereof.

25. The absorbent structure of Claim 17, wherein the absorbent second layer comprises at least one of the group consisting of thermoplastic foams, thermoset foams, cellulosic foams, superabsorbent foams, foam materials with superabsorbent particles embedded therein, non-foam materials with superabsorbent particles embedded therein, fibrous materials with superabsorbent particles embedded therein, coforms, staple fiber webs, netting, scrims, superabsorbent scrims, superabsorbent films, spunbond with superabsorbents, meltblown with superabsorbents, elastomeric materials, and combinations thereof.

26. The absorbent structure of Claim 17, wherein the absorbent second layer comprises a superabsorbent material.

27. The absorbent structure of Claim 17, wherein at least one of the first and second layers comprises at least one slit to control shaping.

28. The absorbent structure of Claim 17, wherein at least one of the first and second layers comprises at least one region of reduced expansion.

29. The absorbent structure of Claim 28, wherein the at least one region of reduced expansion has been modified by at least one of the group consisting of densification, embossment, heat treatment, adhesive bonding, ultrasonic bonding, and combinations thereof.

30. An absorbent article, comprising:

a body side liner;

an outer cover; and

an absorbent structure having a basis weight between about 50 and about 1000 grams per square meter positioned between the body side liner and the outer cover, wherein the absorbent structure includes a first surface opposite a second surface, the second surface of the absorbent structure is bonded to the outer cover, the absorbent structure expands along the second surface in the presence of a liquid so that the first surface increases concavity in the presence of the liquid, the absorbent structure expands to a lesser extent along the first surface than the absorbent structure expands along the second surface in the presence of the liquid, and the absorbent structure has a fluid intake rate of at least about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test.

31. The absorbent article of Claim 30, wherein the absorbent structure comprises a single layer of absorbent material.

32. The absorbent article of Claim 31, wherein the single layer of absorbent material comprises at least one of the group consisting of thermoplastic foams, thermoset foams, cellulosic foams, superabsorbent foams, foam materials with superabsorbent particles embedded therein, non-foam materials with superabsorbent

particles embedded therein, fibrous materials with superabsorbent particles embedded therein, coforms, staple fiber webs, netting, scrims, superabsorbent scrims, superabsorbent films, spunbond with superabsorbents, meltblown with superabsorbents, elastomeric materials, and combinations thereof.

33. The absorbent article of Claim 30, wherein the first surface is a surface of a first layer and the second surface is a surface of an absorbent second layer that is bonded to the first layer, the second layer expands in the presence of a liquid and increases concavity toward the first layer along an interface of the first and second layers in the presence of a liquid, and the first layer expands to a lesser extent than the second layer expands in the presence of a liquid.

34. The absorbent article of Claim 33, wherein the first layer comprises at least one of the group consisting of nonwoven materials, wetlaid, airlaid, spunbond, meltblown, coform, bonded-carded webs, foams, tissue, netting, scrim, woven materials, and combinations thereof.

35. The absorbent article of Claim 33, wherein the absorbent second layer comprises at least one of the group consisting of thermoplastic foams, thermoset foams, cellulosic foams, superabsorbent foams, foam materials with superabsorbent particles embedded therein, non-foam materials with superabsorbent particles embedded therein, fibrous materials with superabsorbent particles embedded therein, coforms, staple fiber webs, netting, scrims, superabsorbent scrims, superabsorbent films, spunbond with superabsorbents, meltblown with superabsorbents, and combinations thereof.

36. The absorbent article of Claim 30, wherein the first surface is treated to expand less in the presence of a liquid relative to the extent to which the second surface expands in the presence of a liquid.

37. The absorbent article of Claim 36, wherein the first surface is treated by at least one of the group consisting of necking, creping, pleating, aperturing, and mechanical teasing.

38. The absorbent article of Claim 30, wherein the second surface expands at least 20% in the presence of a liquid.

39. The absorbent article of Claim 30, wherein the absorbent article comprises at least one of the group consisting of personal care absorbent articles and medical absorbent articles.

40. The absorbent article of Claim 30, wherein the absorbent article comprises at least one of the group consisting of diapers, training pants, swimwear, absorbent underpants, child-care pants, adult incontinence products, pads, containers, urinary shields, feminine hygiene products, sanitary napkins, menstrual pads, panty liners, panty shields, interlabials, tampons, medical absorbent garments, drapes, gowns, bandages, wound dressings, underpads, bed pads, cleaning applications, clothing components, filters, athletic and recreation products, construction products, and packaging products.

41. A single-layer absorbent structure, comprising:

a first surface opposite a second surface, wherein the single-layer absorbent structure expands along the second surface in the presence of a liquid so that the first surface increases concavity in the presence of the liquid, the single-layer absorbent structure expands to a lesser extent along the first surface than the single-layer absorbent structure expands along the second surface in the presence of the liquid, the single-layer absorbent structure has a fluid intake rate of about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test, and at least one of the first and second surfaces undergoes anisotropic expansion in the presence of the liquid.

42. An absorbent structure, comprising:

a first layer having a basis weight between about 10 and about 150 grams per square meter that expands less than 10% in the presence of a liquid; and

an absorbent second layer bonded to the first layer, wherein the absorbent second layer expands at least 20% in the presence of the liquid so that the second layer increases concavity along an interface of the first and second layers in the presence of the

liquid, and the absorbent structure has a fluid intake rate of about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test.

43. An absorbent structure, comprising:

a first layer that expands less than 10% in the presence of a liquid; and

an absorbent second layer bonded to the first layer, wherein the absorbent second layer expands at least 20% in the presence of the liquid so that the second layer increases concavity along an interface of the first and second layers in the presence of the liquid, the absorbent structure has a fluid intake rate of about 0.5 cubic centimeters per second or greater measured using the Fluid Intake Rate Test, and only one of the first and second layers is elastomeric.

APPENDIX B (EVIDENCE)

No evidence is submitted pursuant to 37 C.F.R. §§ 1.130, 1.131 or 1.132. Copies of the following evidence and prior art relied upon by the Examiner are attached.

Exhibit A: U.S. Patent 5,460,621 ("Gertzman et al."), entered in an Office Action dated 03 May 2005.

Exhibit B: U.S. Patent 5,591,150 ("Olsen et al."), entered in an Office Action dated 03 May 2005.

Exhibit C: International Publication WO 01/15649 ("Abbas et al."), entered in an Office Action dated 05 April 2006.

EXHIBIT A

U.S. Patent 5,460,621

EXHIBIT C

International Publication WO 01/15649 A1

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 March 2001 (08.03.2001)

PCT

(10) International Publication Number
WO 01/15649 A1

(51) International Patent Classification[7]: A61F 13/534, A61L 15/60

(21) International Application Number: PCT/SE00/01614

(22) International Filing Date: 23 August 2000 (23.08.2000)

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data:
9903072-8 30 August 1999 (30.08.1999) SE

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(81) Designated States (national): AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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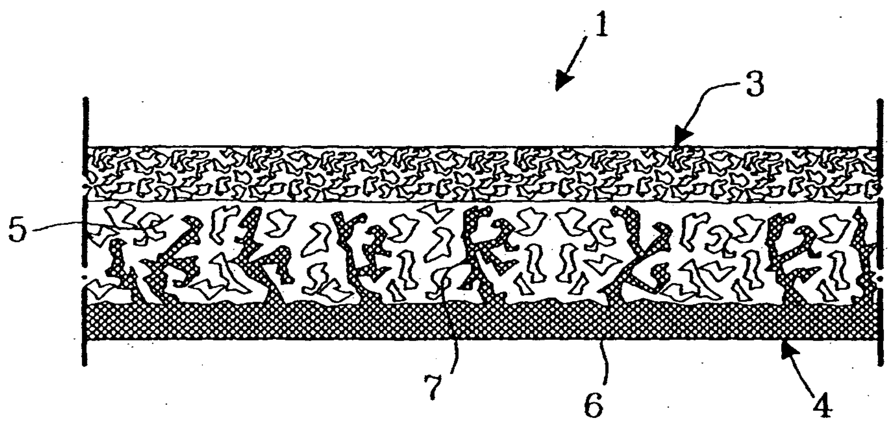
(54) Title: ABSORBENT STRUCTURE IN AN ABSORBENT ARTICLE



(57) Abstract: The invention refers to an absorbent porous structure for use in a diaper, a pant diaper, an incontinence guard, a sanitary napkin or the like, said absorbent porous structure comprising a liquid acquisition portion and a liquid storage portion, at which the liquid acquisition portion comprises a compressed polymeric open-cell foam which expands upon wetting. The liquid acquisition portion and the liquid storage portion are an integrated unit, at which the liquid storage portion comprises a polymeric open-cell foam which may be the same or different from the foam in the liquid acquisition portion. The liquid storage portion also contains a superabsorbent material, at which the amount of superabsorbent material is lower in the part of the liquid storage portion that is located furthest away from the liquid acquisition portion, than in the part of the liquid storage portion that is located closest to the liquid acquisition portion. The invention further refers to a method for producing the absorbent structure and an absorbent article containing an absorbent structure according to the invention.

WO 01/15649 A1

Published:
— *With international search report.*
— *With amended claims.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

ABSORBENT STRUCTURE IN AN ABSORBENT ARTICLE

TECHNICAL FIELD

The present invention refers to an absorbent structure in an absorbent article such as a diaper, a pant diaper, an incontinence guard, a sanitary napkin etc. said absorbent structure comprises a compressed foam, which expands upon wetting. The invention further refers to a method of producing an absorbent article containing an absorbent structure according to the invention.

BACKGROUND

Absorbent articles of the above mentioned kind are intended to absorb body liquids such as urine and blood. Such absorbent articles usually have a liquid pervious topsheet, which during use is facing the wearer's body. They further have a liquid impervious backsheet, e g a plastic film, a plastic coated nonwoven or a hydrophobic nonwoven, and an absorbent structure enclosed between the liquid pervious topsheet and the liquid impervious backsheet. The absorbent structure may comprise two or more layers such as liquid acquisition layer, storage layer and distribution layer.

It is desired that absorbent articles of the above mentioned kind are thin and discrete to use. It is further important that absorbent articles of the above mentioned kind have a high liquid acquisition capacity as well as liquid distributing and liquid storing capacity.

In order to obtain a good liquid acquisition capacity it is important that the liquid acquisition layer has a high momentaneous liquid acquisition capacity. Open, bulky structures with large capillaries have a high momentaneous liquid acquisition capacity and examples of such material are cellulosic fluff pulp of thermomechanic or chemithermomechanic (CTMP) type, chemically stiffened cellulosic fibers, synthetic fiber structures of different kind and porous foam materials.

It is previously known through US-A-3,512,450, EP-A-0 293 208 and EP-A-0 804 913 to use a compressed foam material of regenerated cellulose, e g viscose, as an absorbent structure in an absorbent article of the above mentioned kind, e g a sanitary napkin. The article may then be made very thin and still have a high absorption capacity. The compressed viscose foam expands quickly i the z-direction when liquid is absorbed by the material when wetted. From EP-A-0 293 208 it is further known that such an absorbent structure can contain superabsorbent material.

As storage layer it is commonly used cellulosic fluff pulp with admixture of superabsorbents, i e crosslinked polymers with the ability to absorb liquid several times their own weight. In order to obtain a thin diaper with a maintained total absorption capacity, it is desired to increase the amount of superabsorbent material in the fluff pulp network. In order to make it possible to increase the amount of superabsorbent material it is for example through EP 0 532 002 in absorbent structures known to use superabsorbent material having a good liquid distributing capacity.

Through EP 0 212 618 and EP 0 478 011 it is known to use an absorbent structure that seen in its thickness direction has a gradually increasing concentration of superabsorbent particles, at which a higher concentration of superabsorbent material is localized to the portion of the absorbent structure that during use is placed closest to the liquid impervious backsheet. By using such a structure the risk for gelblocking and an improved liquid distribution is achieved. One problem with such a structure is however that it from processability point of view is difficult to apply the superabsorbent particles so that a gradually increasing particle concentration is achieved in the thickness direction of the structure.

DESCRIPTION OF THE INVENTION

The problem of providing an absorbent article which is comfortable and discrete to wear, at the same time as it has both a high liquid acquisition capacity and a high liquid distribution capacity, has been substantially eliminated by the present invention.

According to the invention there is provided an absorbent porous structure for use in a diaper, a pant diaper, an incontinence guard, a sanitary napkin etc. and which is provided with a liquid acquisition portion and a liquid storage portion, at which the liquid acquisition portion comprises a compressed polymeric open-cell foam which expands upon wetting, and which is characterized by the liquid acquisition portion and the liquid storage portion being an integrated unit, at which the liquid storage portion comprises a polymeric open-cell foam which may be the same or different from the foam in the liquid acquisition portion, and that the liquid storage portion also contains a superabsorbent material. In the portion of the liquid storage portion that is located closest to the liquid acquisition portion the amount of superabsorbent material is lower than in the portion of the liquid storage portion that is located furthest away from the liquid acquisition portion. One advantage of the invention is that the total absorption capacity of the absorbent structure is utilized to a higher degree than if the amount of

superabsorbent material is the same in the entire liquid storage layer. In the upper part of the liquid storage layer it is important that the liquid has the ability to be distributed in the longitudinal direction of the structure from the longitudinal mid portion of the structure which coincides with the wetting area, out towards the longitudinal end portions of the absorbent structure. In the lower part of the liquid storage portion it is however mainly important that the absorption capacity is so high that the article has the ability to store so much liquid as possible without leaking.

Thus with the present invention there is obtained an integrated absorbent structure which has a high liquid acquisition capacity as well as a high liquid distribution and liquid storage capacity. An integrated absorbent structure is more advantageous than an absorbent structure comprising different layers since the joining step is eliminated. This involves that the structure is cheaper to manufacture. The problem of having a bad liquid transfer between different layers is further eliminated in an integrated structure. The reason for usually having a worse liquid transfer between different layers than in an integrated structure depends on that it is difficult to achieve a sufficiently good contact between different layers. Another advantage relating to a foam absorbent structure is that it is more flexible and pliable than a fibrous structure. Another advantage with a foam-formed structure is that it is easier to provide a uniform basis weight in the longitudinal and transverse direction of the structure. It has however proved to be difficult to provide a matformed fiber structure having a sufficiently uniform basis weight.

According to a preferred embodiment the amount of superabsorbent material increases gradually in the z-direction of the of the liquid storage portion from the part of the liquid storage portion that is located closest to the liquid acquisition portion to the part of the liquid storage portion that is located furthest away from the liquid acquisition portion. Such an embodiment is advantageous since it reduces the risk for gelblocking further.

According to one embodiment the portion of the liquid storage portion that as seen in the z-direction is located remote from the liquid acquisition portion only comprises superabsorbent material.

According to an embodiment the superabsorbent material is a porous open-cell foam structure. The advantage of having the superabsorbent material in the form of a foam, is that it is possible to obtain liquid transport between the pores in the superabsorbent material. It is especially important that the superabsorbent material per se has the ability

to transport liquid when the amount of superabsorbent is high, i e in the lower part of the liquid storage portion. When the superabsorbent material is in the form of an open-cell foam structure it is also possible that the absorbent material according to the invention only consists of the superabsorbent material. It is also possible that the superabsorbent material comprises a film-forming polymer, which forms a film coating on the pore walls of the foam. Another advantage of having the superabsorbent material in the form of a foam or a film-forming coating, is that such a structure is easy to produce since the difficulties of applying superabsorbent particles in a thickness gradient are eliminated. In such a structure the problem of dusting caused by the smallest superabsorbent particles in the manufacture is eliminated.

The superabsorbent material can for example be based on polyacrylate. It is also possible that the superabsorbent material is based on cellulose or starch.

According to a preferred embodiment the compressed foam structure comprises a regenerated cellulose structure, so called viscose foam. An advantage with a foam of regenerated cellulose is that such a foam when wetted has a very high swelling ability in the z-direction of the structure. This involves that such an article can be very thin before wetting. It is also an advantageous material for articles that are to be shaped into a three-dimensional shape upon wetting, such as for example hump-shaped sanitary napkins. By the fact that the three-dimensional shape appears upon wetting it is possible to produce articles that still are thin and discrete before use.

According to an embodiment the regenerated cellulose foam structure also includes fibers. By incorporating fibrous elements in the regenerated foam structure an improved liquid distributing capacity is achieved.

According to one embodiment the foam structure in the liquid acquisition portion is in dry condition more compressed than the foam structure in the liquid storage portion.

The invention also refers to a method for producing an absorbent structure according to the invention. Such a structure is obtained by shaping a foam material, which is compressed and then dried. After drying the structure a monomer solution of superabsorbent material is added to one of the opposite sides of the foam material, as seen in the z-direction, at which the part of the compressed foam that is wetted by the monomer solution expands. The polymer solution is then polymerized and crosslinked. The structure may optionally be compressed further, after which it is finally dried.

The invention also refers to an absorbent article such as incontinence guard, diaper, pant diaper, sanitary napkin and the like and of the kind comprising a liquid pervious topsheet, a liquid impervious backsheet and an absorbent structure applied there-between, said absorbent structure containing a structure as disclosed above.

Description of the drawings

Fig. 1 shows a schematic cross-section through an absorbent structure according to the invention in compressed form, in which the structure in z-direction comprises a liquid acquisition portion and a liquid storage portion.

Fig. 2 shows the absorbent structure according to figure 1 in expanded form.

Fig. 3 shows in a view from above an absorbent article in the form of an incontinence guard.

Fig. 4 shows an electron microscope picture (ESEM) of a viscose foam without a superabsorbent film forming coating.

Fig. 5 shows an electron microscope picture (ESEM) of a viscose foam according to the invention with a superabsorbent film forming coating.

Description of embodiments

The integrated absorbent structure 1 comprises seen in the in z-direction a liquid acquisition portion 3 and a liquid storage portion 4. The liquid acquisition portion 3 and the liquid storage portion 4 comprises a compressed foam material, which upon liquid contact expands strongly under simultaneous absorption of liquid. Examples of such a foam material is regenerated cellulose. The foam material in the liquid storage portion 4 also comprises a superabsorbent material. When manufacturing the absorbent structure a monomer solution of the superabsorbent is added to one side of the compressed foam. Upon application of the monomer solution to the compressed foam this will expand in the area which is wetted by the monomer solution. This involves that the foam material in the liquid storage portion in dry condition is not so strongly compressed as the foam material in the liquid acquisition portion. The amount of superabsorbent material in the liquid acquisition portion 4 is lowest closest to the liquid acquisition portion and highest

furthest away from the liquid acquisition portion. The liquid storage portion 4 in the absorbent structure in figure 1 comprises, as seen in the z-direction, two different portions 5,6. The first portion 5 is located adjacent the liquid acqusition portion 3 and the other portion is located remote from the liquid acquisition portion 3. The first portion 5 comprises the compressed foam, at which the superabsorbent material is placed in the open cells 7 of one part of the porous compressed foam. The other portion 6 consists of only the superabsorbent material. The superabsorbent material is preferably in the form of a foam, but it is also possible that it is in the form of a film-forming gel. The liquid storage portion can of course also consist of only the first portion 5, at which the amount of superabsorbent material decreases towards the liquid acqusition portion.

Figure 2 shows the absorbent structure according to figure 1 in expanded form, i e when the absorbent structure has been wetted during use of the absorbent structure in an absorbent article. The liquid acquisition portion 3 and the liquid storage portion 4 have expanded in the z-direction. The liquid acquisition portion 3 which in dry condition is more compressed than the liquid storage portion 4 has thus expanded more than the liquid acquisition portion 4.

The amount of superabsorbent material in the liquid storage portion is over 20 weight percent, based on the total weight of the liquid storage portion in dry condition. Preferably the amount of superabsorbent material is over 50 weight percent in the liquid storage portion.

When manufacturing the absorbent porous structure a foam material is formed, which is compressed and then dried. After that a monomer solution of the superabsorbent material is applied to one of the opposite sides of the foam material, as seen in the z-direction. Then the monomer solution is polymerized and crosslinked. The part of the compressed foam which is wetted by the monomer solution is somewhat expanded, while the part of the compressed foam that, as seen in the z-direction, is located furthest away from the side wetted by the monomer solution, is not wetted and therefore not expands. Since the liquid acqusition portion consists of the part of the compressed foam that, as seen in the z-direction, is located furthest away form the side wetted by the monomer solution, and thus is more compressed, a more rapid liquid acqusition is obtained in the liquid acqusition portion than in the liquid distribution portion. It is also possible to compress the structure further after application of the superabsorbent material.

The monomer solution can be in the form of a solution which upon application on the compressed foam trickles down into the open pores of the compressed foam and forms a filmlike coating. By the fact that a part of the monomer solution trickles into and penetrates part of the open pore system of the compressed foam, there will be obtained a gradually decreasing amount of superabsorbent material in the liquid storage portion of the foam material in the direction away from the side on which the monomer solution has been applied, i e there will be a gradually increasing amount of superabsorbent in the liquid storage portion 4 in the direction away from the liquid acquisition portion 3. The monomer solution can also be in the form of a foamed dispersion solution which after application against one side of the compressed foam is polymerized and crosslinked. The advantage of applying the superabsorbent material in the form of a foamed dispersion solution is that a porous structure is also formed of the superabsorbent material, which involves that the liquid transport in the liquid storage portion is improved. By applying the superabsorbent material in the form of a foamed dispersion solution it is also possible to provide a liquid storage portion which to 100% consists of the superabsorbent material.

It is further possible that the entire absorbent porous structure, i e both the liquid storage portion and the liquid acquisition portion, to 100% consists of a compressed superabsorbent foam. In order to obtain good liquid acquisition properties in the liquid acquisition layer the superabsorbent material in this layer is highly crosslinked. A very highly crosslinked superabsorbent material can not receive so much liquid as a super-absorbent having a lower degree of crosslinking, but on the other side a highly crosslinked superaborbent is better to maintain liquid under pressure. The liquid storage portion in such a structure is crosslinked to a lower degree.

According to a preferred embodiment the foam material is regenerated cellulose, such as viscose, which is a foam comprising a skeleton of cellulose. An advantage of having a foam material of regenerated cellulose is that such a structure has a higher stiffness than foam structures of superabsorbent material based on polyacrylate. Foam materials of regenerated cellulose herewith create firmness to the liquid storage portion.

The principle of making a porous viscose foam is known since long ago and shortly takes place in the following way. Cellulose, usually sulphite pulp, is allowed to swell in sodium hydroxide. Carbon disulphide is added at which the cellulose is successively dissolved. In order to improve the mechanical strength in the material for example cotton fibers may be added. To this cellulose solution there is added and dispersed a salt

in the form of sodium sulphate. When then the solution is heated the cellulosed is regenerated (the carbon disulphide is evaporated) and the salt (sodium sulphate) is dissolved by washing the material with water at which a porous spongelike structure is obtained. The material is dried and compressed if desired

It is also possible to provide an absorbent structure which in its thickness direction has a pore size gradient. In order to provide such a pore size gradient different viscose solutions are used, which are applied on top of each other and then regenerated. Sodium sulphate with different particle sizes is used in the different layers, at which a different pore size of the foam is obtained. By the fact that the different layers are placed on top of each other before they are dry there is achieved an integrated structure, in which the layers partly penetrate into each other.

After regeneration of the cellulose and washing for removing the salt particles the material is dried and compressed to the desired density, which should be in the interval 0.1 to 2.0 g/cm^3. The material will upon liquid absorption expand quickly in volume from 2 to 20 times, preferably from 2 to 15 times its volume in compressed condition. The increase of volume at the absorption mainly occurs in the compression direction, i e in the z-direction of the material.

In order to provide a viscose foam containing a certain amount of fibers that are anchored to the pore walls of the foam, fibers can be added to the viscose solution before the foam is shaped. It is also possible to interrupt the dissolving of the cellulose fibers at the addition of the carbon disulphide, so that all fibers are not dissolved. The dissolving can for example be interrupted when 50 weight percent of the cellulose fibers have been dissolved, based on the total dry weight of the cellulose fibers.

The foam may of course be of an optional polymeric material and it is possible to create different mean pore sizes of the respective foam layers by other methods than described above by means of salt crystals of different particle sizes. One such alternative way is to use different types of foaming agents when producing the different foam layers, and which provide different mean pore sizes. Another way is to influence the foaming process in such a way, e g by heating the different layers to different degrees during foaming. In this case it would be possible to use the same foaming agent in the different layers.

The foam materials in the liquid acquisition layer 3 and the liquid storage layer 4

respectively can be the same. It is however also possible to use different foam materials in the different layers, at which for example a hydrophilicity gradient would be created in the z-direction by having foams of different hydrophilicity/hydrophobicty in the different layers 3 and 4 respectively.

In figure 3 there is shown an absorbent article 30 in the form of an incontinence guard comprising a liquid pervious topsheet 31, a liquid impervious backsheet 32 and absorbent structure 33 according to the invention applied therebetween. The liquid pervious topsheet 31 may be a nonwoven material, e g a spunbond material of synthetic filaments, a thermobonded material, e g a bonded carded fibrous material or a perforated plastic film. The liquid impervious backsheet 32 usually consists of a plastic film, a nonwoven material coated with a liquid impervious material or a hydrophobic nonwoven which resists liquid penetration. The topsheet 31 and the backsheet 32 has a somewhat larger extension in the plane than the absorbent structure 33 and extends outside the edges thereof. The layers 31 and 32 are interconnected within the projecting portions, for example by gluing or welding with heat or ultrasonic.

It is noted that an incontinence guard according to the invention is not limited to embodiment show in the drawing, but the shape of the article as well as its overall design can be varied. The absorbent article can also comprise a diaper, a pant diaper, a sanitary napkin, a bed protection or the like.

The absorbent structure according to the invention may also be arranged over only a part of the total surface of the absorbent body of the absorbent article, e g at the intended wetting area where the discharged body fluid will be deposited and which usually is located towards the front part of the article. The portions of the absorbent body located outside the intended wetting area may then be of another optional absorbent material. It is also possible that the liquid acquisition portion is only located over the area which is intended to be the wetting area, while the liquid storage portion is arranged over the entire surface of the absorbent structure. Such an embodiment is especially preferred when using the absorbent structure in a sanitary napkin. The liquid acquisition portion swells upon discharge of liquid in the z-direction and forms a hump.

The invention is of course not limited to the above mentioned embodiments, but may of course be applied in other embodiments within the scope of the following claims.

CLAIMS

1. An absorbent porous structure in an absorbent article such as a diaper, a pant diaper, an incontinence guard, a sanitary napkin or the like, said absorbent porous structure comprising a liquid acqusition portion and a liquid storage portion, at which the liquid acquisition portion comprises a compressed polymeric open-cell foam which expands upon wetting,
c h a r a c t e r i z e d i n that the liquid acquisition portion and the liquid storage portion are an integrated unit, at which the liquid storage portion comprises a polymeric open-cell foam which may be the same or different from the foam in the liquid acquisition portion, and that the liquid storage portion also contains a superabsorbent material, and that the liquid storage portion also contains a superabsorbent material, at which the amount of superabsorbent material is lower in the part of the liquid storage portion that is remote from the liquid acquisition portion than in the part of the liquid storage portion that is located closest to the liquid acquisition portion.

2. An absorbent structure as claimed in claim 1,
c h a r a c t e r i z e d i n that the amount of superabsorbent material in the z-direction of the liquid storage portion gradually increases from the part of the liquid storage portion that is located closest the liquid acquisition portion to the part of the liquid storage portion that is located furthest away from the liquid acqusition portion.

3. An absorbent structure as claimed in claim 1 or 2,
c h a r a c t e r i z e d i n that the part of the liquid storage portion in the z-direction of the absorbent article that is located furthest away from the liquid acquisition portion only consists of the superabsorbent material.

4. An absorbent structure as claimed in any of claims 1-3,
c h a r a c t e r i z e d i n that the superabsorbent material is a foam.

5. An absorbent structure as claimed in any of claims 1-3,
c h a r a c t e r i z e d i n that the superabsorbent material is a film-forming polymer forming a film coating on the pore walls of the foam.

6. An absorbent structure as claimed in any of the preceding claims, characterized in that the superabsorbent material is based on polyacrylate.

7. An absorbent structure as claimed in any of the preceding claims, characterized in that the superabsorbent material is based on cellulose or starch.

8. An absorbent structure as claimed in any of the preceding claims, characterized in that the compressed foam structure is a regenerated cellulose structure.

9. An absorbent structure as claimed in any of the preceding claims, characterized in that the regenerated cellulose structure also comprises fibers.

10. An absorbent structure as claimed in any of the preceding claims, characterized in that the foam structure in the liquid acquisition portion in dry condition is more compressed than the foam structure in the liquid storage portion in dry condition.

11. Method of producing an absorbent porous structure in an absorbent article such as a diaper, a pant diaper, an incontinence guard, a sanitary napkin, a wound dressing, a bed protection and the like, characterized in
shaping a foam material, which is compressed and then dried, after which a monomer solution of superabsorbent material is applied to one of opposite sides of the foam material, as seen in the z-direction, at which the part of the compressed foam that is wetted by the monomer solution expands, after which the polymer solution is polymerized and crosslinked and the foam structure is dried.

12. Absorbent article such as an incontinence guard, diaper, pant diaper, sanitary napkin or the like and of the kind comprising a liquid pervious topsheet, a liquid impervious backsheet and an absorbent structure arranged therebetween, characterized in that it contains an absorbent structure as claimed in any of claims 1-11.

AMENDED CLAIMS

[received by the International Bureau on 09 January 2001 (09.01.01); original claims 1-12 replaced by new claims 1-9 (2 pages)]

1. An absorbent porous structure in an absorbent article such as a diaper, a pant diaper, an incontinence guard, a sanitary napkin or the like, said absorbent porous structure comprising a liquid acqusition portion and a liquid storage portion, at which the liquid acquisition portion comprises a compressed polymeric open-cell foam which expands upon wetting, wherein the liquid acquisition portion and the liquid storage portion are an integrated unit, at which the liquid storage portion comprises a polymeric open-cell foam which may be the same or different from the foam in the liquid acquisition portion,
c h a r a c t e r i z e d i n and that the liquid storage portion also contains a superabsorbent material, the superabsorbent material being in the form of a film-forming polymer or a foam which has penetrated the liquid storage portion, the amount of superabsorbent material in the z-direction of the liquid storage portion gradually increases from the part of the liquid storage portion that is located closest the liquid acquisition portion to the part of the liquid storage portion that is located furthest away from the liquid acqusition portion.

2. An absorbent structure as claimed in claim 1,
c h a r a c t e r i z e d i n that the part of the liquid storage portion in the z-direction of the absorbent article that is located furthest away from the liquid acquisition portion only consists of the superabsorbent material.

3. An absorbent structure as claimed in claim 1 or 2,
c h a r a c t e r i z e d i n that the superabsorbent material is based on polyacrylate.

4. An absorbent structure as claimed in any of the preceding claims,
c h a r a c t e r i z e d i n that the superabsorbent material is based on cellulose or starch.

5. An absorbent structure as claimed in any of the preceding claims,
c h a r a c t e r i z e d i n that the compressed foam structure is a regenerated cellulose structure.

6. An absorbent structure as claimed in claim 5, characterized in that the regenerated cellulose structure also comprises fibers.

7. An absorbent structure as claimed in any of the preceding claims, characterized in that the foam structure in the liquid acquisition portion in dry condition is more compressed than the foam structure in the liquid storage portion in dry condition.

8. Method of producing an absorbent porous structure in an absorbent article such as a diaper, a pant diaper, an incontinence guard, a sanitary napkin, a wound dressing, a bed protection and the like, characterized in shaping a foam material, which is compressed and then dried, after which a monomer solution of superabsorbent material is applied to one of opposite sides of the foam material, as seen in the z-direction, at which the part of the compressed foam that is wetted by the monomer solution expands, after which the polymer solution is polymerized and crosslinked and the foam structure is dried.

9. Absorbent article such as an incontinence guard, diaper, pant diaper, sanitary napkin or the like and of the kind comprising a liquid pervious topsheet, a liquid impervious backsheet and an absorbent structure arranged therebetween, characterized in that it contains an absorbent structure as claimed in any of claims 1-8.

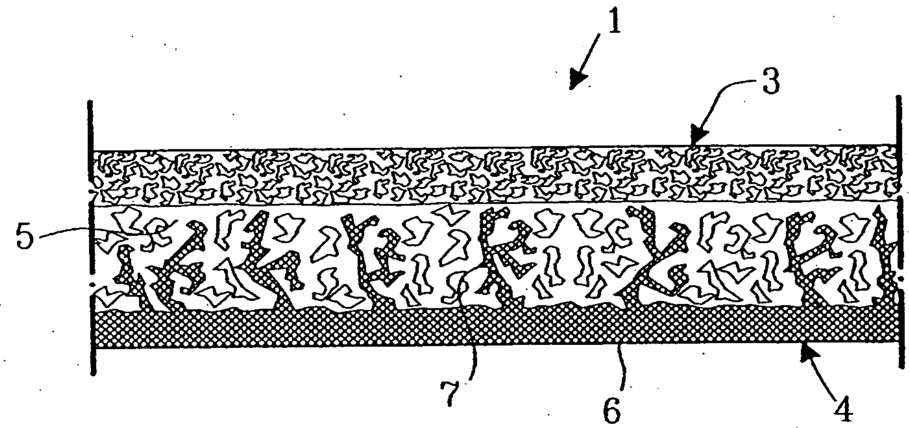


FIG. 1

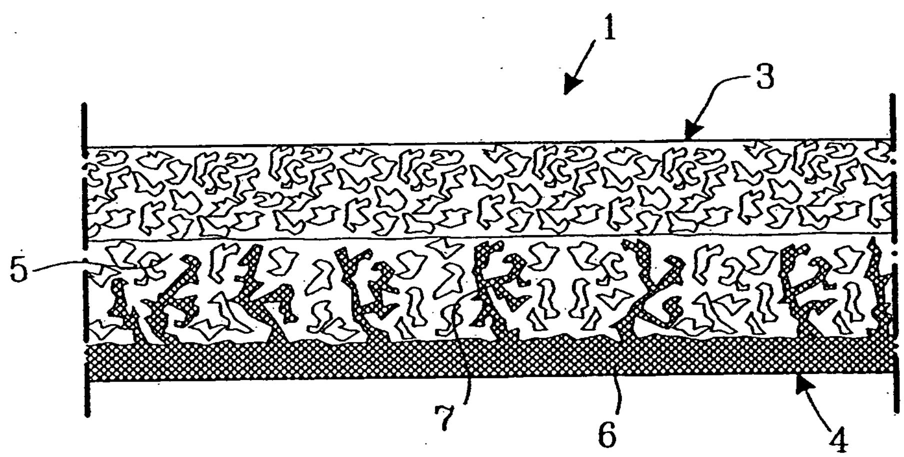


FIG. 2

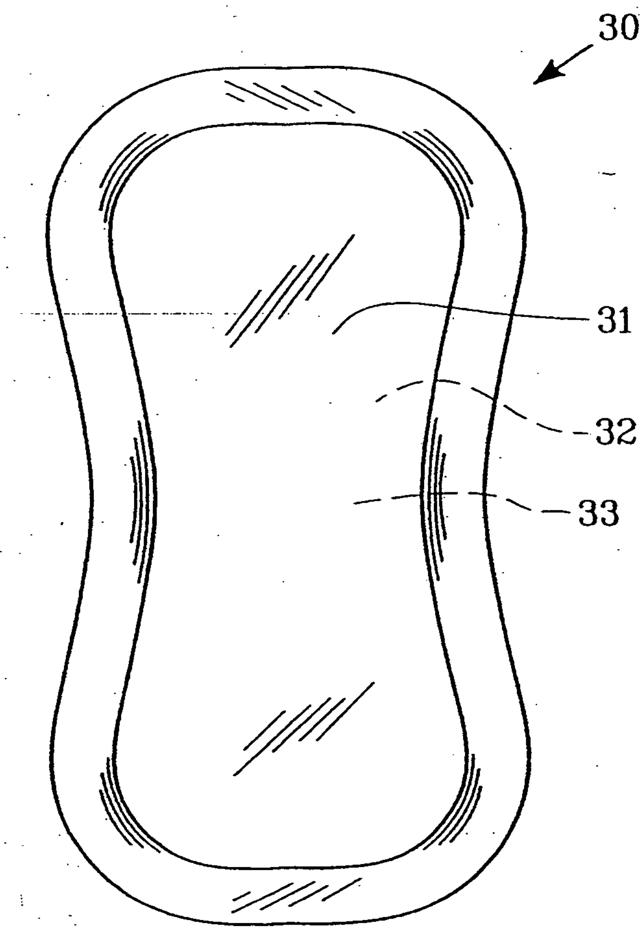


FIG.3

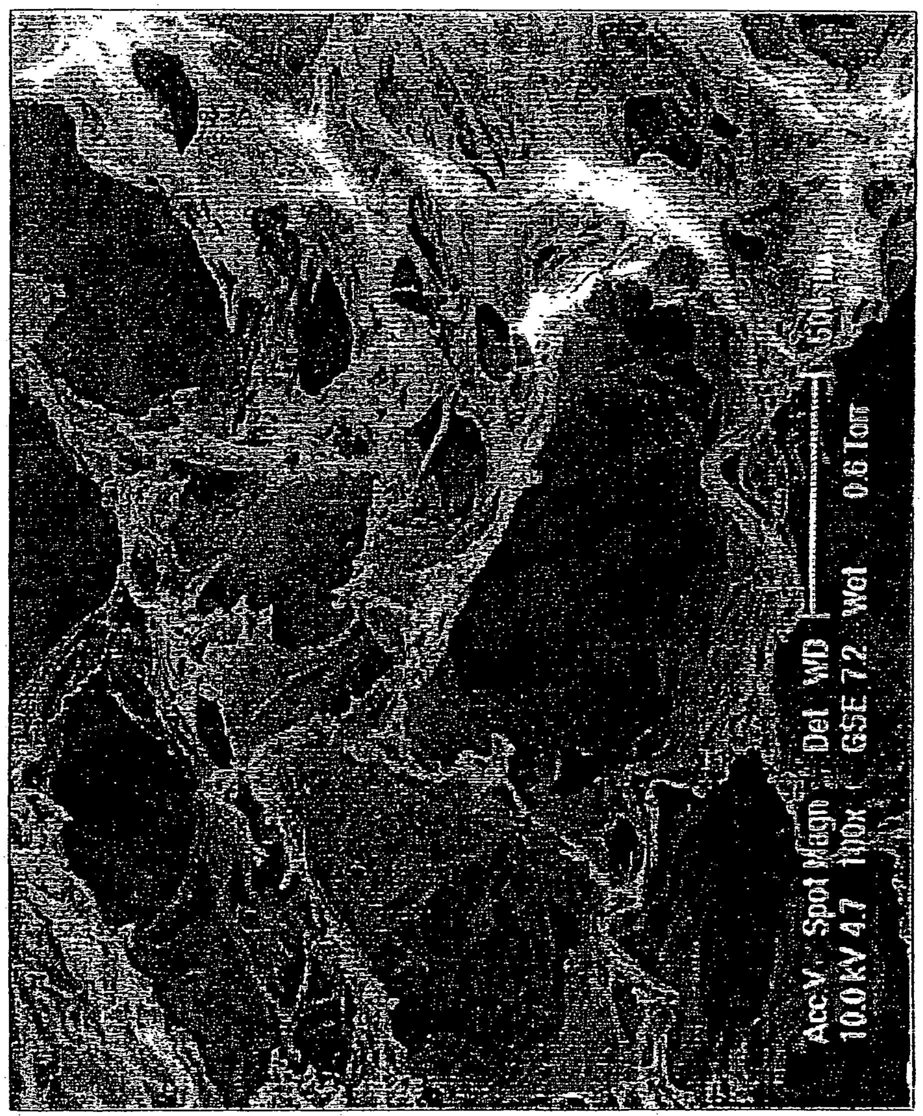


FIG.4

FIG.5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01614

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61F 13/534, A61L 15/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A61F, A61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 9732612 A1 (THE PROCTER & GAMBLE COMPANY), 12 Sept 1997 (12.09.97), page 1, line 10 - line 12; page 13, line 4 - line 6; page 35, line 33 - page 36, line 2, figure 18, claim 1 --	1-10
Y	EP 0478011 A2 (KIMBERLY-CLARK CORPORATION), 14 April 1992 (14.04.92), page 10, line 36 - line 40, claim 3 --	1-3,6-7
Y	US 5338766 A (DEAN V. PHAN ET AL), 16 August 1994 (16.08.94), abstract --	4

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 November 2000	23 -11- 2000

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4957810 A (BERNARDELEQUET ET AL), 18 Sept 1990 (18.09.90), page 2, line 28 - line 31 --	5
X	EP 0293208 A1 (LION CORPORATION), 30 November 1988 (30.11.88), page 3, line 35 - line 39	11-12
Y	page 2, line 21 - line 22; page 2, line 42 -- ---------	8-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE 00/01614

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE 00/01614

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		JP 1026280 A	27/01/89
		JP 1145061 A	07/06/89

APPENDIX C (RELATED PROCEEDINGS)

There are no related proceedings.